Critical sustainability in the design studio. Pedagogic change through student engagement and collaboration.

ROBERT GROVER, PROF. STEPHEN EMMITT, DR. ALEX COPPING.
University of Bath, UK.

ABSTRACT

Preparing the architects of tomorrow for the challenges of rapidly shifting global, regional and local environments must be at the forefront of architectural education. Sustainability is an essential concept that requires critical appraisal to develop innovative and successful means of addressing its issues. This research considers a final year MArch studio at a leading UK institution and asks how a critical appreciation of sustainability may be developed in students about to enter the architectural profession.

The research describes the results of an ethnographic study into the design studio to identify domains for change in collaboration with learners. It goes on to discuss the development of a sustainable design community of practice to developed strategies for enhancing critical sustainability.

Adopting a bottom-up approach the research sought to challenge hierarchical pedagogies and develop strategies that engender deep learning, meaningful behavioural changes and an inquisitive and nuanced approach to sustainability. Approaching architectural education from a learner perspective offered new and valuable insights into the relationship between sustainability and the design studio. Four domains for change were identified; the course structure and content, the specific learning experiences, the ethos and attitudes represented, and the context of the learning.

KEYWORDS sustainability, critical thinking, architecture pedagogy, design studio, action research

1. Introduction

Preparing the architects of tomorrow for the challenges of rapidly shifting global, regional and local environments must be at the forefront of architectural education. Sustainability is an essential concept that requires critical appraisal to develop successful design strategies. This research considers a final year MArch studio at a leading UK institution and asks how a critical appreciation of sustainability may be developed in students about to enter the architectural profession.

Mainstreaming sustainability should be a primary concern when developing architectural courses[1] and a core value that pervades the curriculum emphasising the relationship between discrete modules.[2] Courses must embrace the holistic nature of sustainability as well as avoiding assumptions about the future.[3] Perceptions and attitudes towards sustainability must change in learners before effective teaching can take place.[4]

Deep learning is a key strategy for educating

architects for critical engagement with issues of sustainable development.[5] It is associated with analysis and creative-restructuring of information requiring a holistic and multi-disciplinary appreciation of sustainability.[6] Promoting the design studio as central to architectural education has been identified as essential to developing deep learning.[7] Indeed it appears the ideal site for deep sustainability as it encourages both independent and problem-based learning.[8] Teaching sustainability through the design studio can increase critical engagement and awareness of its multi-faceted nature, encouraging acceptance that it is a contestable and value led concept.[9] The design studio also has the potential to encourage transdisciplinary learning.[10]

Despite the body of literature describing the need for deep learning in the design studio there is little research conducted from a learner perspective with most studies considering an educator-centric approach.

2. Reflection-in-action, Experiential Learning Theory and Deep Learning

The design studio remains the primary means of educating architects and it describes an environment, an event and a pedagogy.[11] The nature of learning in the design studio was described by Donald Schön[12] who refers to multiple reflective processes embedded in action. *Reflection-in-action* describes a process of simultaneous creation and evaluation through engaging with professional tools, such as sketching, drawing and model making. In contrast, *reflection-on-action* is a conscious act happening after the event and may take place in design reviews or *critiques* (crits). Through experience of the iterative process of design, students, absorb knowledge unconsciously which becomes tacit. *Knowing-in-action* describes this understanding and the ability to apply it obtained through previous experiences of *reflection-in* and *reflection-on* action.

These processes can be categorised by their speed of decision making: *knowing-in action* occurring instantly; *reflection-in-action* occurring rapidly and simultaneously with doing; and *reflection-on-action* occurring slowly and deliberately.[13] These reflective processes are linked to the concepts of single and double loop learning described by Schön and Argyris.[14] The former refers to a process of inward problem solving within accepted bounds, while the latter describes reflecting critically on those actions, learning from failure and questioning assumed values.

Kolb's Experiential Learning Theory (ELT)[15] has been identified as a means of achieving effective deep learning.[16] Where Schön's theory is limited in scope and description, ELT has a breadth that can accommodate the holistic nature of learning. ELT frames learning as a four stage cyclical process whereby the learner moves between opposing notions of perception (grasping knowledge) and process. Knowledge is *grasped* through either *concrete experience* (specific encounters founded in the real world) or through *abstract conceptualisation* (knowledge in the theoretical domain). It is processed through the opposing actions of *reflective observation* (conscious analysis) or *active experimentation* (hands-on activity).

In ELT, deep learning can be considered as the integration of the four modes of learning representing the change from the focus on one particular learning style towards a holistic approach.[17] According to Kolb, an environment that enables deep learning must cater for the four modes of the experiential learning cycle and encourage activities that involve conceptual knowledge acquisition, active experimentation, concrete experience and reflective observation. Transitions between these modes must be fluid and an idealised deep learning spiral continuously '*touches*' each of these elements.[18] Providing space for diverse learning modes and emphasising higher level integrative practices or double-loop learning is therefore essential for deep-learning.

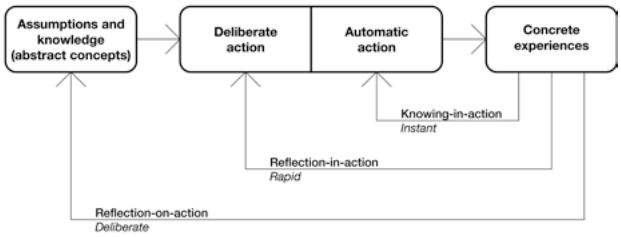

Figure 1. Processes for deep learning in the architectural design studio (Robert Grover)

Figure 1 presents Kolb's learning cycle with reference to the various modes of reflection defined by Schön. *Knowledge-in-action* and *reflection-in-action* shortcut the whole learning cycle and fail to address the critique of assumptive knowledge of *reflection-on-action.* It is the double loop learning cycle in

which deliberate reflection enables the critique of assumptions and prior knowledge.

3. Communities of practice

Placing learners at the centre of the environment is necessary for experiential learning[19] and provides opportunities for change from a bottom-up, learner perspective. Empowering students to become agents of change should be at the forefront of sustainable learning in order to develop social and collaborative action. A Community of Practice (CoP) may offer a vehicle for this action. A CoP is formed when a group of people with a common agenda engage in a collaborative learning effort, both for individual and group benefit.[20] It is defined by three primary characteristics: the domain, the community and the practice.[21]

The domain defines the common interests of the group. It is the purpose of the community to define the activities and practices that it undertakes, share ideas and exchange knowledge.[22] In this instance the domain is sustainable design and its critical application in the design studio. The studio may offer a site for generating such a community which must have a shared practice. Together, they develop the tools, the ways of working and methodologies to address the issues within their particular domain.

CoPs may provide a platform for deep and experiential learning by allowing learners to define their own learning, generate shared knowledge, engage in collaborative processes and provided an environment for critical dialogue.[23] It may enable broader reflective practices by standing adjacent to traditional studio practice.

Stages of the development of CoPs within organisations and for the benefits of members invariably begin with an initial inquiry followed by design, prototype and expansion.[24] A sustainable design CoP may be involved in developing learning at all stages of the experiential learning cycle. This involves critiquing existing sustainability approaches in the design studio, enhancing relevant, learner-centred conceptual knowledge acquisition, developing expertise and skills, developing and testing alternative design methodologies, increasing exposure to exemplar projects and methods and allowing for exposure to a wider range of perspectives.

4. Methodology

This paper asks to what extent the traditional design studio provides an environment for holistic experiential learning which may enable deep learning for sustainability through meta-reflective practices. It forms the initial inquiry to the creation of a sustainable design CoP.

The research adopted a *naturalistic* paradigm and as such it was conducted in a natural setting and results are contextual, value-bound and consist of various overlapping realities which generated *working hypotheses*, rather than concrete theory.[25] This approach is appropriate when considering forming a CoP. Firstly it is purposive, that is it samples a particular context in which the CoP is to be formed. Secondly, it responds to the participatory nature of a CoP by developing emergent theory and design which responds to the particular characteristics of the population.[26]

The initial inquiry stage took place between October 2016 and February 2017. An ethnographic study was undertaken to identify issues and possible domains for change. The participants in the study were final year MArch (RIBA 2) students at the study University of the 2015 Intake. The participants were typically in their sixth year of formal architectural education.

The researcher was a member of staff in the department but not directly involved in teaching on the MArch course in order to avoid possible bias. The role of the researcher was predominantly be one of *observer-as-participant*.[27] In this role most data were gathered through relatively formal settings, (scheduled interviews and planned observations) in which the researcher was considered *'acceptable incompetent'*.[28] In all cases the participants were aware of the presence and role of the observer. The researcher's role allowed a passive approach that limited impact on the students. The openness of the study and knowledge of participants negated the potential ethical implications of a more immersive researcher role. It allowed a broader data set to be gathered, maintained a suitable distance from the subjects and avoided possible ethical issues. Consideration was also given to discretion in interviews, responsibilities to student welfare, preferential treatment and respecting the attitudes of students to remain anonymous.

Data collection began in October 2016 and involved

a cyclical process of collection, analysis and validation which informed further cycles.[29] A voluntary sample of 12 participants within the population (n=30) were interviewed for between 15 and 30 minutes each to limit disruption to student's learning. This provided a baseline understanding and informed further data collection and analysis and provided a manageable and relatively small sample which was examined in its entirety. As well as students, a number of educators on the course provided supplementary interviews.

Data saturation is an important concept in the creation of theory however, its application in this case to the naturalistic paradigm used is problematic. Sampling of more students was impossible without ethical implications due to the number of volunteer interviews. The timescale of the studio limited data collection to a three-month period which defined when the researcher exited the field. Instead the study seeks transparency through the description of collection methods and findings and accepts further exploration may be required.[30]

The field of study was the final year MArch design studio at the study university taking place over a single academic year. This allowed participants to have a reflective view on their architectural education and were most likely to go into architectural practice, maximising potential impact of the research. The MArch course is organised through a single studio in which all students undertake a self-defined project in a European city of their choice. The first half of the year is organised into groups, each of which undertake a masterplanning project. The second half is an individual project in the chosen city with a brief defined by the student. Studio tutors support the students and in the second half of the year each student is assigned a tutor to guide them through the project. The participants had a sophisticated level of design ability and could articulate values and understand issues.

Data Collection

At the start of the year (October 2016) the voluntary sample of participants were interviewed using a semi-structured interview guide approach.[31] This approach enabled comprehensive data collection while allowing space to explore emergent themes and develop open ended answers. A similar technique was employed when interviewing educators.

Observations of crits were undertaken by the researcher in a *naturalistic* manner.[32] The crits provided a formal educational encounter which provided data on the student/educator. Observations were noted and categorised in-situ paying particular attention to the theming of discussions taking place in the crit as well as the nature of this dialogue.

Student design reports, completed at the end of the first semester, course materials (primarily studio assignments), intended learning outcomes and RIBA and ARB validation criteria provided *ex post facto* data that were analysed and triangulated with the observational and interview data collected.

Analysis

Analysis of the data occurred in tandem with collection allowing a continuous process of verification and theory generation.[33] On a practical level, the researcher could deal with a large quantity of data and sufficiently narrow the field of inquiry in later study.

The method of data analysis was based on a modified constant comparative method.[34] Due to the aim of the naturalistic paradigm to understand multiple competing realities rather than enabling prediction,[35] the stages of analysis is limited to data processing, continuous development and the development '*working hypotheses*'.[36]

These approaches can be synthesised into a seven step process[37] in which data were unitised (coded), clustered into domains, relationships established, inferences made, summarised, negative cases sought and theory generated.[38] NVivo, software which supports qualitative and mixed methods research, was used to analyse and code the data.

5. Results

Content and product

In the MArch studio, sustainability was the explicit primary driver of the project brief (the project was entitled *Sustainable Cities*) and highlighted the importance of *extremely low carbon propositions.* Students were required to develop a *conceptual, reflective and critical* approach to architectural inquiry. Sustainability became the *raison d'être* for urban intervention highlighted by a number of students:

"Because [sustainability] becomes our design agenda you are almost forced to do it. We are creating a

sustainable city. It's in the name so you're almost forced to do it." (Student 002)

Analysis of final projects and crits (formal pin-ups reviewed publicly by a panel of architects) revealed that although students actively engaged with sustainability issues they exhibited narrow conceptual approaches tending to focus on local environmental issues (such as sustainable transport and the impact of de-industrialisation) and regional issues (such as water shortages and air pollution). For example, one scheme created a '*forest ring'* around the centre of the city which was explicitly intended to promote healthy lifestyles and biodiversity. By contrast, few schemes addressed global environmental concerns such as climate change or resource depletion, nor the reduction of use and generation of sustainable energy.

Despite a clear ability to create coherent architectural realities, deep technical knowledge was rarely demonstrated through experimental work or technical analyses. An exception to this was one group who linked urban greening to carbon sequestration. Nevertheless, sustainable design tended to remain at a strategic level although was occasionally supported by rudimentary calculations.

A characteristic of the MArch was an emphasis on product often at the expense of process and experimentation. This was evident at formal pin-ups (crits) where even at interim stages there was a reluctance to show unfinished work, failed options, sketches or experiment with alternative presentation formats.

Students were assessed on their ability to transform sustainable knowledge into practical solutions through the vehicle of completed designs. This was reflected in crits that tended to focus on specific spatial manifestations of concepts (such as the creation of green infrastructure, parks and 'eco-transport' corridors) rather than questioning assumptions and knowledge about sustainable design. While there was clear evidence of independent scholarly study, students were given little credit for assimilating skills. Critics often lacked the specific knowledge to critique solutions on a technical level. For example, in one crit, carbon sequestration had to be explained to the critics.

Student attitudes and experiences

Students frequently demonstrated personal interest in sustainability. External experiences, especially placements and previous degrees, were particularly influential in forming concrete ideas through engagement with design techniques. Two students had extended their design knowledge through becoming certified PassivHaus consultants in their own time. This contrasted dramatically with their student work in which they often exhibited apathy or disinterest. As one student stated:

"In my household we're quite keen on measuring energy usage and are involved in community projects, that kind of stuff, whereas in practice I feel I don't consider it as much as you might expect to." (Student 006)

This void between attitude and practice was, according to a number of students, because sustainable design was not considered particularly interesting in the context of the design studio nor was it *"the real agenda"* (student 008).

Working in a foreign context was clearly valued by students and exposed them to issues of sustainability that were cited in interviews and clearly addressed in design work. This, however, led to some disassociation with the issues encountered and there was no evidence of linking this knowledge back to their own personal experience.

Culture and environment

Many students described the University and the course as having a strong embedded sustainable agenda however this did not permeate through to the attitudes of educators and tutors, nor the underlying principles of the design studio.

"Individual tutors didn't real necessarily talk about [sustainability]. Sometimes if you mentioned it but it would be nice if you had one." (Student 005)

Students were isolated from the wider activities of researchers in the department and there was little interaction. For example, none of the tutors and critics involved in the course were practising academics. Most learning took place within the design studio environment involving the same set of individuals and tutors. There were no visits to exemplar sustainable buildings despite clear desire from a number of students.

"I'm trying to think if we've been on any site trips to specifically sustainable places...until you see it in a project that's actually happened, rather than a masterplan that hasn't happened...that's really when it

hits home, and you realise this is actually achievable." (Student 004)

One student spoke of their desire to have a more '*conference like'* atmosphere where professionals and experts from a wide range of fields come and share their knowledge, currently absent in the isolated design studio.

The MArch studio provided limited opportunity for peer interaction through shared studios. The studio was broken down into smaller rooms which meant it was only on crit days (approximately once a month) that the entire cohort was able to view one another's work. One tutor expressed concern for the capacity of the space to facilitate *"sharing ideas"*. Moreover, crit spaces were in a separate building, isolated from the studios which limited the length of exposure to the work of others.

Tutor interactions

Teaching in the design studio took place through a number of tutor interactions in the form of crits and tutorials (desk based, one-to-one interactions).

The crit is a mainstay of the MArch studio occurring approximately every 4 weeks throughout each project. Dedicated crit spaces allowed students work to be pinned up simultaneously encouraging observation. The crit was used as a formative exercise (although in one case it provided 5% of the unit assessment). In most cases, crits were conducted by the tutorial staff or other members of the department familiar with the project. In the first semester, the same critics were present at each crit. The format generally lasted for approximately an hour with between fifteen minutes and thirty minutes of student presentation.

Crits were generally student led, that is they determined the length of their presentation (which often restricted the amount of time for feedback) and the subject matter of the crit was determined by the work they had chosen to produce and present. Environmental sustainability was only critiqued when students had chosen to present sustainable themes and in some crits, was only addressed in one discussion topic. Most discussion topics in crits were framed around spatial ideas. The crit was limited by both professional input and student experiences.

Some students suggested that sustainability was not considered interesting by either peers or critics:

"[Critics] quite often want conversations about design. I find students who really have impressive environmental strategies do that in a modest way that isn't necessarily celebrated through their projects." (Student 006)

Tutorials took place in the studio allowing the opportunity for students to observe or become involved in the teaching of peers. In the research period, all students were working in one of six groups who were being seen twice a week by two different architectural tutors. A specialist sustainability and environmental tutor offered tutorials on weekly basis. Tutors were seen as facilitators, rather than transmitters of knowledge. As the sustainability tutor put it:

"I've got to draw things out if they ask. I'm there to help them and to sometimes point out questions that they should be answering themselves." (Tutor)

The wider curriculum

In the 1st year of the MArch, a series of lectures delivered the *'building blocks'* of sustainability for future studio work. The course was delivered by a number of practitioners who each gave a lecture on their speciality. These included indoor environmental quality, sustainable urban drainage, bio-diversity, environmental impact assessment and the social implications of climate change. It emphasised the need for holistic sustainability however students understood its limitation in relation to their work in the design studio.

"It was more the introduction and giving you a taste of how whole systems work but when you apply it to a project, you have to go a bit deeper and research it in a more personal way." (Student 005)

This was echoed by the unit convenor who suggested the course aimed to give a holistic understanding of sustainability concepts which could be utilised in subsequent student design studio projects. This sequential learning was also popular among students who often cited the desire to grasp abstract ideas before application in the studio.

"I think we have the general understanding but whether that is enough to apply it in design. You know what you should have but it's always how can we add this on or put this in and there are certain things that are not as integrated to begin with because you don't know enough about it." (Student 003)

Conversely, the annexing of sustainability to a single module, its lack of relevance to the design studio

and its sequential teaching, meant student learning stopped short of a more complete and holistic learning cycle.

"We had a lecturer last year who, through a series of lectures, was the one who taught us about designing as a system which was something which hadn't come up before and it was a broader look at environment rather than just looking at individual parts...but it's always more effective when it's integrated which is something we haven't had enough of really." (Student 007)

The application of external lectures to design studio product remained unclear. Student projects demonstrated specific and sometimes critical approaches to sustainability, derived from their own research and knowledge application. Students focussed on their own projects to provide the impetus for abstract conceptualisation. Some praised lectures for giving them a holistic overview and exposure to specific precedents.

"I found the lectures pretty good because they've good really nice precedents and you can analyse the precedent through the lectures which teach you how the city works." (Student 005)

As a learning experience, lectures appeared to provide context and exposure to sustainable concepts yet, direct application to studio projects was absent.

Learning in the design studio

Students accepted the necessity for a blended teaching approach including one to one tutorials, seminars and lectures. They exhibited differing preferences; some preferred general knowledge provision of didactic methods while others enjoyed the relevancy and practicality of tutorials despite concern this was too specific to be useful.

Students engaged in significant personal research. They were provided with the space for scholarly study in terms of personal work desks and have access to a large, well-stocked library and a variety of online databases. A number of students cited the importance of being equipped with the tools and training to adequately assess sustainable issues. There was, however, no space or time given for specialist skill acquisition to allow the testing of sustainable ideas, either digitally or physically, and assessments did not require generating experimental data on possible design solutions. Instead, engagement was at a strategic and conceptual level.

In crits and design reports, students were limited in their conception of architecture by the tools they were comfortable using. Drawing and model making led to specifically spatial solutions (arguably the domain of architecture) but often at the expense of sustainability. For example, all schemes presented large scale abstract masterplans with little consideration of resource use or construction implications.

Reflection on personal experiences is an essential part of the individual learning cycle[39] and these experiences were generated through multiple iterations of the design cycle and constitute design product. They were informed by wider collective and personal experiences. Reflective processes operated at four distinct scales in the MArch studio, on a personal level, on a peer level, through private tutorials and through public crits. The experience at each scale could be seen to provide individuals with the professional context required to think critically within their own learning cycle. Reflection on sustainable concepts however, was centred on solving problems rather than questioning assumptions. This was exemplified by the narrow focus on crits on solving organisational problems and strategic spatial coherence rather than questioning the underlying assumptions made by particular sustainable approaches.

6. Discussion

An explicit sustainable agenda underpinned the initial master-planning project of the MArch design studio and projects exhibited strategies for tackling relevant issues. Despite this, there was a narrow range of issues identified, ideological stances and strategic approaches. Intended Learning Outcomes, considered as the *'point of failure'* for projects, misaligned with the explicit intentions of the assignments. Sustainable design was often perceived as being uninteresting or uninspiring in the context of the design studio by students, despite active engagement with environmental issues in their personal lives. Indeed, the implicit values of the design studio appeared to play a stronger role in validating knowledge than the explicit theming of the curriculum.

There was a lack of exposure to broad architectural experiences, exemplar projects and examples of sustainable practice. When students were exposed to unsustainable contexts, there was no attempt in the studio to translate these to local or personal

environments. Although the studio provided space for reflection and discussion, this was focussed around its self-generated product (i.e. the resultant output of the design process) through tutorials, crits and peer interactions. There was limited space for broader reflective practice on conceptual ideas or specific experiences through, for example, seminars. This was reinforced by the limited exposure to critical perspectives and the narrow focus of crits and tutorials which were defined by the student's work presented. As an ELT environment, procedural aspects were emphasised at the expense of a broad range of concrete experiences.

Crits were observed to be inadequate for the assessment or enhancement of deep-sustainability. Their visual emphasis, arbitrary structure, limited range of perspectives and narrow focus led to an environment which was self-referential, often unproductive and failed to question underlying individual and professional assumptions. A formal framework for structuring crits could provide a possible alternative mechanism.[40]

The design studio was perceived to be a predominantly student led environment, however allowing students to define their own learning experiences has been shown to cause the neglecting of sustainability.[41] This was corroborated in the results of this study and reflected in the particular focus of the group crits. Self-directed learning may also impact other areas of the curriculum[42] and could potentially be an unreliable method to develop particular skills or expertise[43].

Abstract knowledge acquisition was generally directed by the requirements of design projects and there was a reliance on accepted skills and techniques to translate these to design proposals. Where students had acquired particular expertise external to the course or expressed particular personal concern for sustainable issues, this often did not filter into design project work. There was little impetus to develop processes beyond the accepted norms of the MArch design studio augmented by the emphasis on final product at the expense of genuine deep learning. The limited tools for design, time constraints and academic pressures limited the creation of innovative and critical knowledge.

The self-referential cycle of the design studio reinforced practice and knowledge confining it to a limited sphere of understanding and demonstrating little evidence of double-loop learning.[44] Collective assumptions inhibited critical engagement with sustainability underpinned by social, institutional and professional conventions. This points towards a '*hidden curriculum*'[45], generated by the isolation of the design studio from a wider social environment. The pedagogy of the MArch studio served to develop *reflection-in-action*,[46] the ability to think like an architect, yet this was confined by a narrow frame of reference. This limited the ability to address sustainable issues, challenge assumptions and create a wide variety of innovative proposals.

The pedagogy of the MArch design studio offered a model for the development of *reflection-in-action* and the establishment of critical processes however stopped short of allowing deep learning for environmental sustainability. It provided space for individual engagement with the four stages of Kolb's learning cycle through individual project led learning.[47] The nature of learning was often defined by student motivation but this in turn was informed by accepted institutional and professional practices. The MArch studio provided the illusion of independence but student process and learning were both consciously bound (through the requirements of assignments) and subliminally influenced (through exposure to a limited range of experiences and perspectives) by the context of study.[48]

7. Conclusion

This ethnographic study revealed both a lack of engagement from students and organisational indifference in the MArch design studio towards sustainability. This was despite students and staff expressing personal motivation for the subject. Moreover, the insular of the design studio, and its lack of exposure to eclectic perspectives developed a culture of competent professionals, with limited world views. *Reflection-in-action* was the primary mode of learning, shortcutting the questioning of prior knowledge and assumed professional practices. Explicit meta-reflective activities (notably the crit and tutorials) failed to step beyond the cultural confines of the profession or the design studio and compounded the prevalence of *single-loop* learning.

The studio presented a highly refined learning process heavily weighted toward active

experimentation and reflection often at the expense of wider experiences or broad knowledge-based learning. Despite this it was seen as an effective means to develop professional competencies and ways of thinking.

Designing for sustainability requires new ways of thinking, often stepping beyond the accepted bounds of a particular field. In the MArch studio, organisational and cultural change is essential to develop truly deep learning for sustainability. A community of practice may offer an opportunity to expand accepted modes of thinking and provide space for holistic experiential learning and *reflection-on-action* in the design studio.

A CoP may offer an opportunity to develop a learning space beyond the traditional design studio which would allow critical analysis of assumed knowledge and the expression of unconventional and culturally challenging ideas. In the context of sustainability, this could be used to encourage collaboration, interdisciplinary knowledge sharing, a *'research-based approach'* and above all a critical reflective approach to sustainability.[49]

Arguably, the MArch design studio is a CoP. The community is formed through interrelations that are developed by working in a shared environment (the design studio). Practice emerges through this interaction and knowledge shared through direct and indirect interaction with peers. Yet the domain of the design studio is loose and often ill-defined. Although assignments form a rough guideline, students are encouraged to develop their own project briefs and explore their own design agendas, often undermining the formation of strong communities of practice.

Without pedagogic and organisational change, a fledgling CoP must offer experiences beyond the studio to share and develop knowledge. This may be through meetings which promote formal interaction of members and informal interactions within the design studio. Social media platforms may offer opportunities for engagement. Meetings of a CoP must support collaborative and independent learning and have a student led focus. Experts outside of the community could contribute to knowledge creation.

The results suggest that there is sufficient motivation in the MArch studio to form a community brought together through a common domain to develop a sustainable practice. The creation of a sustainable design CoP has not yet been tested in the design studio. This provides an opportunity for further research which will be conducted between 2017 and 2019.

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